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FRONT COVER

A Field of Millet in China

Millet is the most important crop of semiarid North China. More grain per acre is obtained, under growing conditions there, from millet than from wheat.

BACK COVER

World Map—Millet Production

By far the greater part of world production of millet is in the Eastern Hemisphere, largely in Asia. This grain is particularly important for food in North China and India.

NEWS NOTES

Cotton Specialist Goes to Europe

Francis H. Whitaker, Cotton Branch, P. M. A., on temporary assignment to OFAR, left early in October for Europe. He will study cotton utilization and sources of supply in France, Italy, Spain, Portugal, Switzerland, Belgium, and the United Kingdom during a 4-month period, returning to this country about mid-February.

Dr. Moyer Returns to China

As a member of a joint (China-U. S.) rural reconstruction mission, *Dr. Raymond T. Moyer* returned to China in late September. The Mission's work involves consideration of broad agricultural problems in China and recommendations for reconstruction of rural areas.

P. K. Norris Returns From South America

P. K. Norris, Agricultural Economist, of OFAR, returned early in October from South America, after having completed a 4-month study of cotton production and utilization in Brazil, Argentina, and Paraguay. A detailed report of his survey will be published by this Office.

Dr. Ogdon Reports on ECA Work

Montell E. Ogdon, of this Office, who has been in Paris with the European headquarters of the Economic Cooperation Administration for the past 2 months as farm-machinery adviser to OEEC, recently returned to Washington to report on his work and field trips to the Netherlands and to Belgium. While in Paris he attended conferences on farm machinery with the 16 ERP countries. After a short stay in Washington, he returned to Europe as a member of a five-man survey team that planned to visit most, if not all, of the ERP countries to study their farm-machinery needs.

OFAR Official in London

Floyd E. Davis, OFAR, as a member of the United States Delegation, attended the Second Meeting of the International Wool Study Group in London, October 4–6. The purpose of the meeting was to exchange information and consider problems relating to the wool situation and to plan for improvements in the organization and program of the Study Group.

NOTE.—Indexes to volume 11 (1947) of FOREIGN AGRICULTURE and Volume 7 (1947) of AGRICULTURE IN THE AMERICAS may be obtained upon request to the Office of Foreign Agricultural Relations, United States Department of Agriculture, Washington 25, D. C.

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Millet Provides Food For Millions

Few people in the Western Hemisphere know millet by sight. In Africa, eastern Europe, and Asia, however, the tiny millet seeds bulk large in the food supplies of many densely populated areas.

by ELNA ANDERSON

Millet is grown and used as food in many foreign countries, but in the United States it is little known as a food grain. A comparatively small quantity enters international trade, because it is usually consumed in the producing country. World production of millet averaged 26,200,000 short tons for the period 1934–38, compared with 171,000,000 of wheat, 110,300,000 of rice, and 47,500,000 of rye. A large part of the world production of millet is grown in Asia, Africa, and Russia where most of it is consumed as food. (See map on back cover page.)

Millet is known as a "poor man's cereal" and is often called an "inferior" grain. Probably the principal reason for these aspersions is that some kinds of millet have a strong taste. Also, in some parts of the world certain varieties will grow where it is too hot or dry, and the land is too poor, for other cereal crops. When people are given free choice, they seem to prefer such cereals as wheat and rice, which are bland and mild of taste, or tasteless. Studies of the nutritive value of millet show that it compares favorably in this respect with other cereal grains.

Millet, one of the oldest of the cereals, was a common bread grain in the ancient world. Use of millet as a food dates back to prehistoric ages, but little is known about its origin. Some students believe that it was the first cultivated crop, having been grown in the so-called Hoe Age, which preceded the Plow Age. It is said to have been used as a food in India, China, and Egypt before there were written records.

In ancient and medieval times, millet was grown in most of the known world. In medieval times it was one of the principal foods of the poorer people of Rome and of Europe generally. During the nineteenth century, this cereal was gradually superseded in western Europe by wheat, rye, rice, maize (corn), and potatoes.

Miss Anderson is Agricultural Statistician, Statistical and Historical Research Division, Bureau of Agricultural Economics.

This article is based on her study, "World Production and Consumption of Millet and Sorghum," completed in January 1946.

As millet lacks some of the qualities required for making a good raised bread, the development of yeast-raised bread was partly responsible for the decline in the use of millet in western Europe. At present, millet's share in world production of cereals is less than in the past, because it has been gradually replaced in most occidental countries by other foods, especially by wheat and corn and, to some extent, by potatoes. Only small quantities are now grown in western Europe, and these are utilized mainly for poultry feed. In eastern Europe, millet still serves as food in the form of porridge and flat bread. It is also used for making alcoholic drinks. Large quantities are also grown for food purposes in China, India, Manchuria, parts of Africa, and Asiatic Russia.

Perhaps the main reason for the survival of millet as an important food grain in large sections of the world is that most varieties produce, under conditions of intense heat and scanty rainfall, a greater quantity of grain than do other cereals. In addition, most varieties of millet do not demand a rich soil; some grow in soil that would not support other grains. Millet can be grown under primitive conditions with little cultivation; it persists where methods of cultivation have changed little for centuries. Most varieties have an additional advantage in that they require

Field workers gathering a long-season variety of millet grown on the central plains of Shansi, China. The size of the heads, which are packed with grain, gives an indication of the high yields obtained from millet.

Millet packed on a cart for transporting to the threshing floor.

only a short growing season. In India, where much depends on when the monsoon arrives, millet is very valuable. If the monsoon comes too late for other spring grains, millet is planted, and this produces some kind of crop. It is also valuable as a second or catch crop. Another advantage is that seed requirements are small in bulk, because the seeds are relatively small. This is important in such countries as India and China where many poor people who live on the land find it difficult to save sufficient grain for the next season's seeding.

Of the many kinds of millet produced in various parts of the world, five kinds are important for food purposes. These are known as cattail, finger, bread, foxtail, and barnyard millets. Sorghum is often classed as a kind of millet by European writers, but in the United States this is not done. Sorghum is therefore not included in this report.

Cattail millet (*Pennisetum glaucum*), also known as pearl millet, is the "bajra" of India. It makes a minimum claim on soil and moisture but requires hot weather. Growing best in a dry, light soil, it thrives on plains that have extended dry periods, such as those of the Western Ghats and Rajputana, in India, and in the Sudan near the Sahara.

Finger millet (*Eleusine coracana*), also known as little millet, is the "ragi" of India. The plant is hardy, grows in almost any soil, and, in contrast to other millets, thrives in a moist climate where rains are not too heavy. Hardy enough to grow at an altitude of 6 to 7 thousand feet in the Himalayas on rocky land, the plants also make only modest demands on soil.

Bread millet (*Panicum miliaceum*), often called proso, grows farther north than any other millet, for instance in central Russia. The crop grows fast and can stand a good deal of drought but demands better soil than the millets listed above. Bread millet is especially suited to a dry continental climate, such as that of central Asia.

Foxtail millet (*Setaria italica*), sometimes called Italian millet, needs a fairly good soil and high temperatures. The growing season is longer, but this type withstands drought better than the bread millet.

Barnyard millet (*Echinochloa crusgali*), also called Japanese millet, is the barnyard grass of the United States. A relative is guinea grass, a native of tropical Africa, which grows 8 feet high and yields a nutritious grain; a similar species also grows on the banks of the Amazon. Another relative, found in Australia, is eaten by the natives. The Koda millet in India is also related.

Reliable statistics for millet are difficult to obtain, because this grain is grown and consumed principally in Asiatic and African countries where crop reporting has not been so well developed as in Europe and America, and because so little millet is exported or imported. Official statistics have been used when available; when not, unofficial estimates have been included in the estimates for total production and consumption in this study. The figures are conservative, however; because although millet is known to be grown in certain countries of Asia and Africa no indication of the size of the crops is obtainable.

Estimated world production of millet for the period 1934–38 averaged 26,200,000 short tons, and consumption for food averaged 22,300,000 tons, or 85 percent of the total crop. About 6 percent, or 1,500,000 tons, was fed to livestock and fowls.

In China, which produces about a third of the world crop, millet is one of the staple foods. In southern China the people depend principally upon rice, but in northern China, wheat, millet, and sorghum are the leading food crops.

The kinds of millet cultivated in China are mainly foxtail, proso or bread, and finger. Foxtail millet, by far the most important, is grown in Hopei, Shantung, Honan, and Shansi Provinces and in North China generally. This hardy plant, which grows in many regions where other cereals do not thrive, is found in the mountainous sections as well as the plains of many parts of China. Bread millet is grown principally in the Provinces of Shantung, Hopei, Shansi, and Kansu. Sometimes it is used in making a kind of wine. Finger millet is not extensively grown; it occurs mainly in Shantung, Shansi, and Szechwan, and is often used for beer making, for which it is well suited.

Millet is among India's chief food crops. Production of this grain averaged 5,720,000 short tons in the

period 1934–38, compared with 10,980,000 tons of wheat and 28,533,000 tons of rice. Large quantities of wheat and rice are exported, but virtually all the millet is consumed within the country, mostly as food. The stalks, straw, and some of the grain furnish feed.

Some kind of millet is grown in most parts of India, but the principal producing sections are central and southeastern India, where the climate is especially suitable. Heavy monsoon rains furnish necessary moisture during the planting season at the beginning of the summer, and the lack of moisture in later months does not discourage the development of millet, whereas wheat and rice do not thrive. If the monsoon is late in arriving, cattail millet is substituted for sorghum if seed is available, because it is able to produce some kind of crop with a small amount of moisture. If the monsoon fails entirely, a famine is inevitable, but in recent years these famines have been much less severe because of importation of food supplies by the Government.

First in importance among the millets of India is cattail millet or "bajra," production of which averaged 3,140,000 short tons for the period 1934–38. Most of it is grown in the dry western section of India and is the principal food of the people. It thrives on light sandy soil, little moisture, and hot weather. There are two chief districts for the cultivation of cattail millet, one in Bombay, Rajputana, and the adjoining Ganges plains, and the other in the dry section of the Western Ghats and in Madras. It appears as far south as the southern tip of the peninsula, where it is sometimes grown as a winter crop.

Finger millet or "ragi" is next in importance among the millets of India; about 2,580,000 short tons were produced on the average during the period 1934–38. Grown mainly in southern India, this grain is used for making bread, cakes, and puddings. More than half the acreage of finger millet is in Madras and vicinity, and practically all the remaining acreage is in the native States, mostly Mysore. It appears to thrive in the same climate in which rice thrives and is usually found in India where rice grows. Damp mountain slopes seem to be especially favorable.

In some dry sections finger millet is grown under irrigation, and is sometimes sown between the rows of maize, which often fails to produce a crop. In this case there is still a crop of some sort. Finger millet is seeded following the rainy season, or the seed is sown in May in irrigated beds, and the young plants are transplanted to fields at the beginning of the rainy season. In Gujarat it is grown in alluvial soil and irrigated by floodwater. Here it is often grown as a vegetable, in which case the unripe ears are eaten. In the interior, finger millet is planted on the eastern slope of the Ghats and up to the edge of the Deccan plains. On the damp west coast it is supplanted by rice. In south India, in Madras and Mysore, finger millet occupied two-thirds of the

A good crop of millet, the heads of which will shortly be detached from the stalks and thrown on the floor for threshing. The stalks will be tied in bundles and stored for drying.

planted acreage. The damp climate is especially favorable for the growth of the crop, and sowing and harvesting are dependent on the trade winds. With irrigation, sowing and harvesting are possible throughout the year; so sowing is usually done when water is available.

Although it is not produced to any great extent in India, the natives are very fond of foxtail millet. The plant grows in dry climates but makes great demands on the soil. The Hindus regard the grain as a holy food and often prescribe it for the diet of invalids. Foxtail millet is the principal grain in a small section of the highlands of Mysore, where the climate seems to be especially favorable. Most of it is grown as a summer crop. Bread millet is also grown in certain sections, mostly in southern India, south of the Kistna River, where it is one of the principal foods. Other kinds of millet are grown in many parts of India, but although they are important locally the total production of these for the country is not large.

Another chief millet-producing and millet-consuming area is central Asia and Soviet Russia where proso or bread millet is widely grown. It occurs in the southern half of Soviet Russia and is a staple food throughout the country. In a broad belt running through central and southern Russia, it is one of the important crops and is eaten mostly in the form of a thick porridge called kasha. The nomadic peoples, the Mongolians and the Kirgis, are very fond of millet, and their methods of culture suit the crop. Many sections have little rainfall but receive a water supply from some type of irrigation system supplied by mountain streams.

In Arabia, Syria, Iran, Iraq, and Afghanistan, millet has been cultivated for many centuries. Although it is of much less importance today than formerly, a considerable quantity is grown, and the grain is a staple food for many of the poorer people. In Iran, proso or bread, foxtail, and some cattail millets are grown in the northeastern, southern, and western parts. Cattail millet is found in southwestern Arabia.

Millet is widely grown in Africa, but most of it is produced under extremely primitive conditions. Few dependable statistics are available, but estimates have been made from the information at hand. Cattail and finger millets (often designated as *pennisetum* and *eleusine* in literature on Africa) are grown in many parts of Africa. Millet is produced in some of the oases of the Sahara where a good deal of excellent land is watered by springs. The grain serves as food for the natives, and the stalks provide fuel and building material. Finger millet is grown in many sections of Ethiopia and Somaliland where it is used for food and for making beer. In certain sections, cattail millet predominates; finger millet is the chief crop in other sections where it serves as daily food for the people in the form of porridge and beer. Cattail millet thrives in French Equatorial Africa and in the dry rocky soil around Lake Chad. The climate in tropical East Africa, because of monsoon rains and dry periods, is favorable for the cultivation of millet. In recent years cattail millet and finger millet have not been produced in such large quantities as they formerly were. The climate of Anglo-Egyptian Sudan favors the cultivation of millet, and the crop is important in the savanna.

Millet has now little of its former eminence as a cereal grain in Europe, except in Soviet Russia where proso millet is grown in many parts of the country and is used mainly for porridge or for flat bread. In recent years not much has been grown in Europe outside the Soviet Union, Rumania, Poland, and Yugoslavia. Small amounts are grown in France, Germany, Bulgaria, Austria, and Hungary. In these countries it is used chiefly for feed for animals and fowls, for making beer, or for making brooms.

In Rumania, most of the plantings are of cattail millet and are on the Danube plains. The grain is used mainly for feed but in some localities for bread making. The Bulgarians make a favorite kind of beer from their millet. The small amount produced in Germany is bread millet and is found in the southern or eastern part of the country. Considerable quantities of cattail millet were grown in France until the end of the last century, when production averaged about 575,000 tons, but little is grown now. Small quantities are grown in Spain where, in the last century and before, it was a more important grain.

In the United States, millet is a minor crop and is grown mostly for hay. The grain crop, roughly about 30,000,000 pounds, is consumed as poultry feed, in birdseed mixtures, and for seed. Much of the production is of foxtail millet, grown in Texas, Kansas, Oklahoma, Nebraska, Missouri, Colorado, and Tennessee. A foxtail millet, called Hungarian millet, is grown in Illinois and Indiana. Barnyard or Japanese millet, produced for hay and grain, is found in Pennsylvania, New York, and Iowa. Proso is grown in North Dakota, South Dakota, and Colorado and is used for cattle and chicken feed. It has been found that other cereals outyield millet in the United States, as a rule, except in very dry years.

The mass of the populations of India and China eat the cereal that can be grown locally and cheaply. In India many live chiefly on millet, since much of the

On the threshing floor women generally cut the heads from the stalks, placing the heads and the stalks in separate piles.

soil is too poor or the climate too dry for growing other crops. In China the cereals consumed by the ordinary people are mainly millet, sorghum, wheat, and corn in the north, wheat and rice in the central region, and rice in the south. Much has been written about the insufficiency of certain nutrients in the diets of large segments of the population of China, and, in many of these reports, millet is classed as an "inferior" grain.

Such studies as have been made (mostly in foreign countries) of the nutritive value of millet, compared with that of other cereal grains, indicate that it is, in general, somewhat lower in protein content than wheat and higher in fat content than both wheat and rye. It has a higher protein and fat content than rice. The mineral matter content of most millets is higher than that of sorghums, wheat, rice, and rye, but not of soybeans. There is good indication that millet is a rich source of thiamine.

Studies of diets in China reveal many deficiencies. The people with lower incomes live mostly on cereals. Diets in northern China, where millet is a staple food, show a deficiency of thiamine much less frequently than do the diets in South China where milled rice is the principal cereal consumed. The milling of rice removes most of the thiamine and accounts for the lack of that vitamin in the diet of the poorer people in South China. Millet is used as a whole-grain cereal and, as such, furnishes thiamine in generous amounts.

Certain customs in China improve the nutritive value of the diet. In northern China, millet is mixed with other cereals and legumes. Experiments have shown that the proteins of such mixtures give evidence of supplementary relationships and sometimes show higher biological values than do any of the single cereals or legumes involved. A high biological value is shown in the case of flour made from a mixture of maize, millet, and soybeans. The sprouting of millet is another custom which adds nutrients to the Chinese diet. Good as these customs are, they do not take care of the great deficiencies of needed nutrients.

A common observation is that the poor people of China, India, and many parts of Africa need a more varied diet containing larger quantities of protein, minerals, fats, and vitamins. Because of the extreme poverty of many of the people, however, this will be difficult to attain. Although one of the simplest and most feasible plans would be to encourage the production and consumption of soybeans, potatoes, and fruits, many years are likely to pass before millet ceases to furnish a large part of the food.

Prospects for Japanese Agriculture

by W. I. LADEJINSKY, WARREN H. LEONARD, *and* MARK B. WILLIAMSON

Agriculture is the backbone of the economic life of Japan. The unprecedented program of industrialization in Japan before World War II did not obscure this fact. Agriculture provided employment for more than 40 percent of the population and supplied about 85 percent of the nation's food. In terms of capital invested and net value of output, agriculture in the early 1930's was the leading industry of Japan. Its position is even more nearly dominant now.

Agriculture is the only segment of the Japanese economy that survived the defeat of the country in good condition. Except for the shortage of fertilizer, Japanese agriculture is in a better position now than during World War II, particularly with respect to labor supply. However, agriculture can play only a limited role in the rehabilitation of Japan. Agriculture will not provide all the food the nation will need in the years ahead, nor will it furnish the prewar volume of exportable industrial crops. Reference is made particularly to raw silk, which at one time was the most important item in Japan's export trade. Agriculture in postwar Japan will not be in a position to provide greater employment even though agricultural production should be expanded. Japan already uses most of the available arable land, all of which is intensively cultivated. Under these circumstances, the return from the application of additional labor would be very small. Finally, the additional acreage that might be reclaimed will not affect markedly the overpopulated villages of Japan.

Japan's only solution probably will be to retrace and revise part of the economic course of the 1920's and 1930's. This course consisted of concentrating the nation's resources to an increasing extent on the consumer-goods industries and of attempting to build up an export trade in those goods sufficient to enable the buying of raw materials and the food required. The postwar political and economic changes in the Far East and southeastern Asia are likely to reduce considerably Japan's prewar role as an exporter of this type of goods. The manufacturing of capital goods may well become one of the new features of Japan's export trade in the years to come. Japanese agriculture, even when purged of its worst prewar features, provides only a weak foundation for the rehabilitation of the Japanese economy. When the economy of Japan was purely agricultural, it supported a generally stable population of about 30,000,000 people; the support of an additional 40,000,000 people in less than a century has been made possible primarily through the growth of industry and foreign trade. Only by an increase in industry and trade can Japan support its population, even on a modest basis, in the years immediately ahead.

The Food Problem

GENERAL FOOD REQUIREMENTS: Approximately 82,000,000 people will have to maintain themselves in 1950 on a comparatively small land area (about equal to the State of Montana) that is basically poor in natural resources. The average caloric intake of the Japanese people during 1935–40 was about 2,160 per capita per day. With about the same intake assumed for 1950, the total Japanese food requirement for human consumption will be about 64,500 billion calories or approximately 21,000,000 short tons in brown-rice equivalents.

The question arises as to Japan's ability to meet its food requirements from indigenous production. Self-sufficiency in foodstuffs in Japan, even though desirable, should not be achieved at the expense of the acreage under industrial crops for which there exist both a prime need in the domestic economy and a ready demand abroad. Economically, it is to Japan's advantage to pay for imported food by exporting such products as raw silk and tea. Without a deliberate reduction in the acreage under industrial crops for the sake of greater food self-sufficiency, Japanese agriculture can probably furnish, on the

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Messrs. Ladejinsky, Leonard, and Williamson have been associated in the work of the Agricultural Division, Natural Resources Section, SCAP, in Japan.

This article is an adaptation from their study, "Outlook for Japanese Agriculture," Preliminary No. 25, issued by the Natural Resources Section, General Headquarters, SCAP, Tokyo.

basis of average prewar yields (1936–40) a volume of food estimated at 48,597 billion calories or approximately 16,500,000 short tons in brown-rice equivalents. In terms of 1950 requirements, Japan would have a food deficit of approximately 15,894 billion calories (4,400,000 tons in brown-rice equivalents) or nearly 25 percent of the required food intake.

In the past rice has been the principal deficit food item; the deficit averaged about 2 million short tons, nearly one-fifth of the annual consumption. Imports from Korea and Formosa met most of the deficit. Other important food imports were sugar from Formosa and soybeans from Manchuria. All these were imports from former colonies. Obviously, Japan will not be able to draw on these for food, as in the past, and certainly not in the same manner. It must therefore attempt a greater measure of self-sufficiency in order to reduce the need for food imports.

FUTURE FOOD SELF-SUFFICIENCY: Under the impact of trade restrictions which are likely to be imposed on Japan, and the urgent need of utilizing foreign exchange for imports of raw materials other than food, Japan might make an effort to become totally self-sufficient in food. Any success in such an attempt would depend upon one or more of the following factors: (1) Expansion of arable acreage, (2) higher yields, (3) additional labor for the cultivated acreage, and (4) effect of agrarian reform upon the food supply. An examination of these factors indicates that Japanese agriculture will not be in a position to satisfy the food requirements of the growing population.

In order to ascertain whether the arable-land area of Japan can be expanded, it is necessary to examine the crucial elements which determine the cultivated acreage of the country. The preponderance of hill and mountainous terrain sets definite limits to the cultivated area. It explains why no more than 16 percent of the total area of Japan, or 15,000,000 acres, is cultivated.

Persistent efforts to augment the cultivated acreage have been made during the past 20 years, without marked results. From 1918 to 1939 the amount of land reclaimed annually averaged only 50,000 acres; the amount of land lost to purposes other than agriculture equaled or exceeded that average. The fact that the upward trend in farm acreage has been arrested does not prove that acreage-expansion possibilities have been exhausted. Some reclaimable land remains which could be put into crops.

The Japanese Government prepared a 15-year plan for the reclamation of about 4,100,000 acres, starting in 1945. An evaluation of this 15-year program shows that the reclamation possibilities and anticipated returns are not so great as estimated by the Government. Nearly 43 percent of this land is in Hokkaido, and the remainder is divided among the three other islands. Only 10 percent of the total is considered reclaimable as irrigated rice land; the other 90 percent will be permanent nonirrigated fields, generally of lower quality than those already in cultivation. The scheme, among other things, calls for the creation of new farms from present nonproducing forest land and marsh.

Thus, it appears that most of the desirable land is already in use, most of the reclaimable land left is inferior to the land now in cultivation, the cost of reclamation on some land is prohibitive, and land which is not suitable for reclamation has been included in the program.

Furthermore, a large part of the potentially cultivable land of Japan is situated where both soil and climate are particularly unfavorable. An increase of acreage by double cropping often is not possible, and conversion of uncultivated land into fields in the mountainous areas is difficult and expensive. This explains in great part why the two decades before World War II witnessed no net increase in the cultivated area despite the desire of land-hungry Japanese farmers to add to their small holdings. It helps to explain another recent development in Japanese agriculture. From 1932 to 1939 the wheat area increased by 600,000 acres, but the country's total cultivated area remained virtually unchanged. The

Most of the better land in Japan has been utilized for farming. That remaining for reclamation is mostly on rough terrain in areas of relatively poor soil and unfavorable climatic conditions.

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increase in wheat acreage resulted largely from the displacement of other crops, such as barley and the mulberry bush.

Work on the reclamation program has been accelerated since the surrender. Between July 1, 1945, and December 31, 1947, approximately 700,000 acres were reclaimed, a rate of more than 23,000 acres per month. A close examination of this average shows a gradual decline of the monthly rate from 34,600 (July-June 1945–46) to 14,800 acres (July-December 1947). In the latter period, the rate of reclamation ranged from 27,200 acres in July to 7,400 in December. This work was accomplished under handicaps, particularly the shortage of material and administrative confusion. On the other hand, one-half the reclaimed acreage had been out of crop production only a few years, because of having been in military use. Considering the fact that the greater and vastly more difficult part of the work remains to be done, the rate of reclamation in the years to come will probably be lower than that of the period July-December 1947. The completion of the project by 1960 is, therefore, highly questionable.

Assuming, however, that this ambitious and unrealistic reclamation program will be completed by 1960, what might be Japan's food situation in that year? The Japanese Government, as already indicated, estimates that only 10 percent of the reclaimable land is suitable for irrigated rice fields. Conceivably, therefore, if the entire program were accomplished, the Japanese could expand the cultivated area by 408,000 acres under paddy and 3,669,000 under upland crops.

On the basis of a yield of 1.25 short tons of rice per acre, additional paddy production would exceed 500,000 short tons; a yield of 0.54 ton (brown-rice equivalents) per acre of upland would give an output of 1,980,000 tons of brown-rice equivalents. A total of 2,293,000 tons would be available for human consumption[1] from the reclaimed land. The total volume of food (other than fish) available for consumption in 1960 can be estimated at about 17,600,000 tons of brown-rice equivalent,[2] or 53,360 billion calories. Fish production available for consumption might add another 1,944 billion calories,[3] or an estimated grand total of 55,304 billion calories. In 1960, the requirements of 92 million people consuming an average of 2,160 calories per day are 72,532 billion. Hence, an estimated deficit of 17,228 billion, or 25 percent of the food intake of Japan in 1960, can be expected.

[1] Waste and seed account for the difference between the original total of 2,497,000 tons and the figure of 2,293,000 tons.

[2] This figure is made up of an estimated 2,300,000 tons from the reclaimed land and 15,300,000 tons, which is the average volume of food available for consumption (waste and seed deducted) for the period 1931–46.

[3] The assumption is that a per capita consumption of fish in 1960 will approximate that of 1935–40, or an estimated 75 calories daily.

TABLE 1.—*Rice yields in specified countries, 1935–39*

Country	Average yield per acre of rough rice
	Bushels
Japan	75.8
China	52.5
Formosa	53.0
Korea	51.0
British Malaya	36.3
Java and Madura	31.6
India	26.2
Burma	27.5
Siam	30.1
Philippines	22.2
French Indochina	22.5

But, as already pointed out, Japan's ability to reclaim 4,100,000 acres is problematical. A more realistic approach would be an estimate of food production in Japan in 1960 in terms of a net acreage increase amounting to not more than one-half, or 60 percent, of the planned reclamation program. The estimated food availability from indigenous sources would have to be reduced and the over-all deficit raised accordingly. But whatever the variant used, the continued rapid increase in population, on the one hand, and the limitations of expanding the acreage under cultivation, on the other, will prevent Japan from achieving food self-sufficiency in the next 15 years.

A review of the subject of crop yields in Japan leads also to the same conclusion that Japan must continue to import large amounts of food. In the 60 years preceding 1940, agricultural production in Japan showed a remarkable increase, resulting primarily from increased yields per unit area of land rather than from an extension of the cultivated area. This is best illustrated in the case of rice, the mainstay of Japanese agriculture. Japanese rice yields are much higher than those in other major rice-producing countries (table 1).

The high yields in Japan have resulted from the ample use of manpower, improved rice varieties, abundant use of fertilizers, and improved agricultural practices. Such intensive farming has accentuated the ill effects of multiple cropping, as well as those associated with continuous cropping.

The Japanese are unlikely to be able in the next 5 or 10 years to obtain increases in crop yields above those of the prewar years. Yield trends before 1940

were upward, but the annual rate of increase averaged only 0.3 percent between 1922 and 1940, compared with 1.3 percent up to 1922. This is even more significant in view of the evidence on fertilizer consumption. While the volume of farm-supplied fertilizers scarcely changed between the early 1920's and 1930's, the aggregate amount of commercial fertilizers utilized increased from 3,146,000 in 1922 to 5,241,000 tons in 1936. Since the cultivated acreage during this period remained practically unchanged, the increase indicates a much greater application of fertilizer per unit of land to obtain a small increase in yield. Yield trends show that an even more intensive utilization of fertilizers in the next few years probably would not result in yields high enough to ensure self-sufficiency for Japan in foodstuffs, or to effect much of a reduction in food-import requirements.

A typical Japanese couple repatriated from Manchuria and settled on reclaimed lands.

When the amount of labor already used is considered, it is questionable whether a still greater application of manpower will increase appreciably the productivity of the soil. A paddy field of 1 tan (0.245 acre) with a labor outlay of 15 man-days has been known to produce as much under equal conditions as a field of the same size where 30 man-days have been used. A limit exists above which more labor would not mean more production. In some instances, it is possible that increased labor may result in higher unit area yields, but, in general, higher yields in Japan can hardly be expected from more intensive utilization of labor.

Economically, as well as socially, the agrarian reform instituted by the Japanese Government will have far-reaching effects upon rural Japan. The majority of the tenants are becoming owners, and the benefits accruing to these farmers are significant. As owners they will improve their land more carefully and will spare no effort to increase its productive power. But it would be fallacious to view agrarian reform as a means of raising agricultural production to a point that would furnish Japan with all its food requirements. The effect of the agrarian reform on the food supply of Japan would be vastly different were reform to mean additional acreage under cultivation. This is not possible, and a significantly greater agricultural output cannot be expected as a result of agrarian reform.

Industrial Crops

GENERAL SITUATION: The area devoted to industrial (nonfood) crops in Japan during 1930–34 averaged slightly more than 1,853,000 acres, or about 12 percent of the total area cultivated during that period. The principal industrial crops were mulberry trees, tea, pyrethrum, and tobacco. These crops now occupy approximately 75 percent of the total area devoted to industrial crops. The area in industrial crops in 1947 has been estimated at 828,000 acres, or 5 percent of the total cultivated area. This decline from the 1930–34 area was caused by the replacement of industrial crops with food crops necessitated by food requirements during World War II and by the greatly reduced demand for raw silk.

Some restoration of the area in industrial crops is essential to the Japanese economy and should be effected as soon as the world food situation permits. At that time the amount of food imports into Japan will depend on the amount of foreign-exchange credits available for the purchase of food. Industrial-crop products, such as pyrethrum, tea, and tobacco, will probably be salable in foreign markets at prices which will enable Japan to purchase much more food than could be grown on the area occupied by these industrial crops.

SERICULTURE: Raw silk was Japan's principal source of foreign exchange before World War II. During

the period 1920–30 the annual export value of raw silk from Japan averaged $294,100,000. In 1930, the maximum production year, an area of 1,750,000 acres was planted to mulberries, and 880,000,000 pounds of cocoons and 94,185,000 pounds of raw silk were produced. In the late 1930's raw-silk production and mulberry acreage declined because of competition from synthetic fibers, particularly rayon and nylon. The war greatly accelerated this deline in raw-silk production in Japan by eliminating its silk-export market. Furthermore, in order to meet the food shortage, the Government wartime land-utilization policy called for a shift of much of the mulberry acreage to food crops. As a result of these adverse factors, the estimated mulberry acreage in 1947 was only approximately 432,000 acres, whereas cocoon production has declined to an estimated 11,790,000 pounds and raw silk to 14,601,000 pounds.

The future world silk demand is unpredictable, but it is doubtful if the export demand for Japanese raw silk in the future will exceed one-fourth of the 1930–34 level. Until the prospects for future silk demand are more stabilized, mulberry acreage probably should be limited to approximately 500,000 acres.

OTHER INDUSTRIAL CROPS: Tea production has declined since the 1930–34 period, when an average of 90,400,000 pounds of tea was produced annually on a land area of 94,000 acres. The estimated production in 1947 was 54,977,700 pounds, grown on 64,000 acres. Decreases in yield per acre resulted from shortages of fertilizer and improper care of the tea bushes since 1941. Export demand for Japanese tea will probably warrant moderate increases in tea acreage and production during the next few years.

Present pyrethrum production is inadequate to furnish even domestic requirements. The substantial export market for pyrethrum products and tobacco is not being supplied. Acreage and production of these crops should be increased immediately, particularly for tobacco, since the export market for this commodity is likely to be good for many years to come. (See table 2.)

Low yields per acre for 1947 as compared with the 1930–34 average are caused, as for silk and tea, by fertilizer shortages and general war dislocation.

Other Agricultural Problems

FERTILIZERS: Large applications of fertilizer have always been necessary on Japanese farm lands because of the natural infertility of the soils and the necessity for maximum crop production on a very limited land area. Drastic reduction in fertilizer applications since 1941 has depleted the reserves of plant food in the soil. In order for Japanese agriculture to produce the same amount of agricultural crops as before 1941, as much, or more, fertilizer must be applied to the soil as was applied during 1936–40, the 5-year period of maximum consumption.

TABLE 2.—*Acreage and production of pyrethrum and tobacco in Japan, average 1930–34, annual 1947*

Product	Average 1930–34		1947 (estimated)	
	Acreage	Production	Acreage	Production
	Acres	*Short tons*	*Acres*	*Short tons*
Pyrethrum	37,329	6,635	15,938	1,380
Tobacco	56,885	70,000	102,332	65,905

Japanese Ministry of Agriculture and Forestry.

During this period the average annual consumption of fertilizers was 2,295,000 short tons of commercial nitrogenous fertilizer expressed as ammonium sulfate (20 percent N); 2,022,000 tons of phosphatic fertilizer as superphosphate (16 percent P_2O_5); and 242,500 tons of potassic fertilizers expressed as potassium sulfate (50 percent K_2O).

The Japanese program to reclaim 4,100,000 acres of land, a large proportion of which is inferior to that now under cultivation, will increase the need for additional fertilizer above that consumed from 1936 to 1940. Estimates indicate that during the next few years Japan will require 2,200,000 short tons of nitrogenous fertilizer expressed as ammonium sulfate (20 percent N); 1,650,000 tons of phosphatic fertilizers as superphosphate (16 percent P_2O_5); and 220,000 tons of potassic fertilizers as potassium sulfate (50 percent K_2O). This is the absolute minimum needed to maintain yields approximating those of the prewar years.

Commercial nitrogenous fertilizer production for the 1948 fiscal year is estimated at 1,042,000 tons expressed as ammonium sulfate (20 percent N). Self-sufficiency in nitrogenous fertilizers may be attained by 1950, but this accomplishment will depend upon increased coal production, adequate supply of other critical materials, and maximum rehabilitation of fertilizer plants. It is doubtful if organic fertilizer, such as fish meal or soybean meal, will be available in sufficient quantities to contribute significantly to the nitrogenous-fertilizer supply in the near future.

Japan has depended almost entirely upon imported phosphate rock and potassic salts to meet its needs for phosphatic and potassic fertilizers. Domestic production of commercial phosphatic and potassic fer-

tilizers has met only a small fraction of the annual requirements of Japanese soils. Furthermore, these fertilizers have been of low quality. Estimates indicate that about 2,000,000 short tons of phosphatic fertilizer (16 percent P_2O_5) and 336,000 tons of potassic fertilizers (50 percent K_2O) will be required by the end of 1950.

LIVESTOCK INDUSTRY: Major changes will not occur in the livestock industry during the next 5 years. It will be difficult for the Japanese even to maintain their present livestock population because of increased slaughter to fill the demand for meat and the shortage of feedstuffs, especially of concentrate feeds. The best possibility for the immediate expansion of the livestock industry appears to be an increase in ruminants, particularly sheep and goats. These animals are able to live with comparatively little concentrate feed, and their utilization of roughage offers an opportunity for an improvement in the Japanese diet. However, to effect a substantial increase in ruminants, particularly the larger breeds, improvement and increased utilization of grazing lands are essential. Substantial increases in animals requiring large amounts of concentrate feeds, such as hogs and poultry, are improbable in the near future. Concentrate feeds for livestock have always been imported, and at present practically all concentrates are being used for human consumption.

Immediate Outlook

The factors examined show that Japan cannot provide all its food requirements from domestic sources or reduce its prewar dependence upon imported food. Not even an expanded acreage, as envisaged by the Japanese land-reclamation program, or a reasonable increase in yields, or both, could make Japan self-sufficient in food. The only other means by which to augment the food-crop acreage is a drastic reduction of the area in industrial crops. But such action is not in accord with the best interests of Japan's over-all economic reconstruction. It is well to remember that the proceeds from an acre of mulberries can buy several times the volume of food that could be grown on the same area at present silk prices.

Both Japan and the countries trading with Japan should find it more advantageous for Japan to meet its food shortage by importing food. The countries of the Far East that produce rice, sugar, and soybeans can find in Japan a natural outlet for their products, taking in return consumer or capital goods manufactured in Japan. Through such an exchange Japan should obtain its deficit food requirements. Attempts at food self-sufficiency under conditions now existing in Japan are doomed to failure.

Consideration should be given also to the problem of rural unemployment with which Japan is faced in the years immediately ahead. Even at the height of Japanese industrial development, the shift from farms into industry was hardly sufficient to offset the annual increase of farm population. The population remaining on the farms was too large in relation to the cultivated acreage to find full employment there.

The number of surplus farmers would have been greater except that agricultural techniques in Japan have undergone only a few changes. From 1931 to 1941 the use of machines for processing agricultural products increased considerably, but there was no significant increase in farm equipment used to raise crops.

Shortage of farm equipment during the war put an end to the expanding use of labor-saving devices. The trend now is in the opposite direction, and the surplus labor already existing in the Japanese village will be augmented still further. The consolidation of small agricultural holdings would open more possibilities for labor-saving devices, and one of the principal results of a more efficient use of labor would be the greater need to transfer labor from agricultural to other occupations. More emphasis on the development of rural industries seems advisable. For example, the establishment of small canneries in rural districts might be examined as a means toward creating new fields for employment.

Because of the downward trend in silk production, Japanese agriculture is faced with further unemployment, as well as a considerable decline in income. Two hundred working days are required for cultivating an acre of mulberries and raising the cocoons from the harvested leaves. Less than 100 days are required for cultivation of upland crops on the same acreage. In consequence of the reduction in mulberry acreage, the principal cocoon-raising Prefectures (Nagano, Gifu, Gumma, Yamagata, Saitama, Aichi, and Ibaraki) will be faced with the problem of finding employment for a large reserve of surplus labor.

Thus, improvement in the economic utilization of agricultural resources in terms of land, labor, and equipment would only add to the surplus labor reserve. In that event, the need for alternative occupation, which the farm cannot provide, would be even greater than before the war. The effective remedy lies in the transfer of surplus workers in agriculture to other occupations, primarily to those of an industrial and commercial nature.

Coffee—A Popular World Beverage

by KATHRYN H. WYLIE

For a significant proportion of the adult population in the United States a cup of steaming coffee at breakfast time is a necessity, and several other cups throughout the day add to the joy of living. In order to supply the vast quantities thus required, coffee has become one of the principal complementary products imported into this country. The business of importing, processing, and selling this coffee provides jobs and incomes for hundreds of people, and its indirect economic influences reach thousands more.

Coffee has been among the first half-dozen imports into the United States for years. In 1947 it ranked first, accounting for more than 10 percent of the total value of United States imports estimated at $5,648,500,000. At one time or another during the past 47 years, the value of coffee imports has been surpassed by that of rubber, raw silk, sugar, hides and skins, and wool and mohair. Always, however, coffee has been an outstanding import item, as may be seen in the following tabulation:

Period	*Coffee's rank*	*Products of higher import value*
1901–05	Second	Sugar.
1906–10	Third	Sugar, hides, and skins.
1911–15	Second	Sugar.
1916–20	Sixth	Sugar, silk, hides and skins, rubber, and wool and mohair.
1921–25	Third	Silk, sugar.
1926–30	Third	Silk, rubber.
1931–35	First	
1936–40	Third	Rubber, sugar.
1941–45	First	
1946	First	
1947	First	

Coffee provides the basis of trade with several of the Latin American countries, furnishing the foreign exchange needed to pay for United States exports. For many of the principal coffee-supplying countries, exports of coffee constitute more than half the total value of all their shipments. In others they represent a significant part of the total. For Colombia and El Salvador, for example, three-quarters of total exports are coffee and for Costa Rica, two-thirds; whereas for Brazil, the largest producer, coffee now makes up only 35 percent of the value of all exports.

Although the Western Hemisphere is now the predominant producer and consumer of coffee, this beverage is also popular throughout many other parts of the world. In the years just prior to the war, western Europe took large quantities of coffee beans, and the per capita consumption of coffee in the Scandinavian countries was even higher than that in the United States.

The coffee plant is native to Abyssinia and, perhaps, to Arabia. It was in Arabia, legend tells us, that a goatherd first became aware of coffee by noticing its effects on the goats he was tending. After they ate the leaves and berries from the coffee bushes they would frisk about so gaily that the goatherd decided to try the berries himself. The berries were used first as a medicine, then as a food, and later on they were boiled to produce a beverage. The roasting of coffee resulted, according to legend, from the efforts of the Arabs to maintain a monopoly over coffee growing; they heated the beans before exporting them in order to kill their power of germination.

Coffee rapidly became an important drink in all Arabic-speaking countries and continues so today. From Arabia the coffee beans were carried to other parts of the world, particularly to Europe. The early churchmen, upon learning that the beverage helped them to keep awake during their early morning and late evening devotionals, were instrumental in spreading the coffee-drinking habit. By the seventeenth century coffee houses were located throughout Europe, and they became centers where people gathered for political and social conversation. Small quantities of the beans also moved to the new colonies in North America, but it was not until after the Boston Tea Party of 1773 that coffee began to replace tea as a beverage in America.

Production—Regions and Trends

Most of the world's coffee now comes from the Western Hemisphere, although the beans are grown in many countries lying within a belt reaching from latitudes 28° N. to 38° S., including the original home of the plant in Abyssinia and Arabia. Today Brazil is by far the largest producer, followed by Colombia. Before World War II, the Netherlands East Indies ranked third after Colombia in total production, but their exports have been cut off since 1941.

World coffee production shows a decided long-term upward trend, within which are numerous cycles and short-term periods of declining output. Taking the

relatively recent period from 1913 to date, for example, world production rose through 1937 and thereafter declined sharply through 1945. The pattern of these trends, however, was set by Brazilian production, which represented from 40 to 76 percent of the total during those years. Coffee production in Colombia, on the other hand, still shows the upward trend established earlier, with no decline in the war years or since. Africa, too, has increased its production, and the trend in Mexico is upward, despite a greater cyclical variation than in Colombia and Africa. Production in other areas fluctuates, more or less, around a norm, although in Asia it is somewhat more erratic.

Coffee became a major crop in Brazil in the early years of the nineteenth century. Although coffee trees were first planted in Pará, the region that later developed more productive coffee lands is located in southern Brazil, centering largely in the State of São Paulo; Minas Gerais, Paraná, Espírito Santo, and Rio de Janeiro are also important producing States. Tree numbers increased steadily for 50 years prior to 1934 and reached a peak in that year of almost 3 billion. By 1946, the total number had dropped to 2 billion. Production from these trees tended to increase, but with long- and short-term cycles around the trend. The short-term variation is largely a result of weather changes, whereas the long-term fluctuations appear to follow, by about 5 to 8 years, periods of sustained high or low prices. The present low points of the production cycle, for example, follow the unfavorable prices of the 1930's.

In the countries of the Western Hemisphere that produce mild coffee, the trees grow on the lower mountainsides of the Cordilleras. The important coffee lands of Colombia, for example, are in the Departments of Antioquia, Caldas, Cundinamarca, Tolima, and Valle, following the upland slopes of the three mountain ranges. Production, however, is gradually shifting westward.

Many of the so-called mild coffees grown outside Brazil command a higher price in the market than Brazilian coffee. They are in demand for blending to improve cup flavor and aroma. Before World War II most of these coffees found a ready market, and stocks did not pile up in the producing countries as they did in Brazil. In fact, the demand for these types has increased at the expense of Brazilian coffee.

Consumption Is Expanding

World coffee consumption, both total and on a per capita basis, has increased steadily during the past 40 years, except during the two World War periods. In general, the highest per capita consumption of coffee is in those countries of the North Temperate Zone having a relatively rugged climate during part of the year. The Scandinavian bloc of countries, the United States, and western Europe fall within these definitions. A relatively insignificant proportion of the coffee grown in the principal producing countries is consumed at home, although the per capita consumption is fairly high.

For most of the producing countries, the United States is the best market; in some cases it takes well over half the total of world shipments. Before the war 55 percent of Brazil's exports and 77 percent of Colombia's came to the United States. These percentages rose to 83 and 96 percent, respectively, during World War II. The countries of western Europe offer the second best market, the principal importers before the war having been Germany, France, the Netherlands, and the Scandinavian group. During the war Germany dropped out of the markct altogether, and shipments to other European countries fell drastically, whereas some of the Central and South American Republics became important markets. By 1946, however, Europe began to cnter the

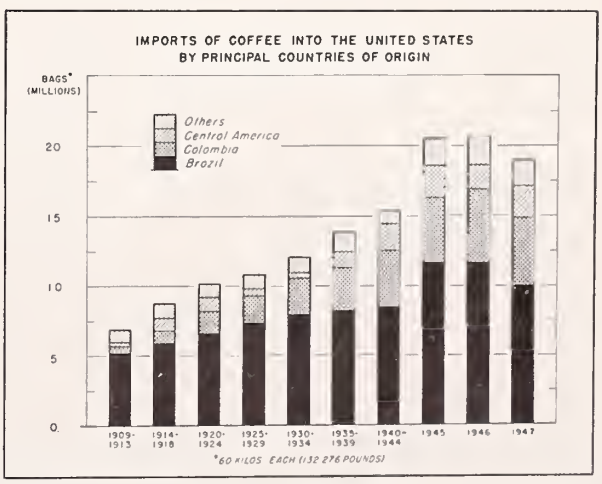

FIGURE 1.—Brazil is the principal source of United States coffee imports.

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market again, and Brazil shipped more than 19 percent of its total exports to that continent.

Imports of coffee into the United States have expanded steadily since 1850, the rate of increase being much more pronounced than that for population growth. Ten- to twenty-year cycles occur around the trend line. Unit import prices for the same period show only a slight upward tendency, but the cyclical variations are sharply marked. Both on a total and per capita basis, coffee consumption rose at an increasing rate during the war years, total imports reaching a peak in 1946 of 2.7 billion pounds, representing around 100 billion cups of coffee.

Brazil has been the principal supplier for the United States market. In 1801, the first year in which imports from that country are listed, they totaled 532 pounds. They reached a peak of 1.5 billion pounds in 1945. In more recent years, however, the share of total coffee imports into the United States supplied by Brazil has declined, and that from the countries producing mild coffee has increased (fig. 1).

Price Movement

The movement of coffee prices over a long period from 1850 to date shows a slight upward trend, the uncorrected data moving in cycles influenced by general business conditions (fig. 2). The level of prices of the mild coffees is somewhat higher than that for Brazilians, the exact variations depending on quality. In addition to general business conditions, prices are influenced by the demand-and-supply situation for coffee as a commodity, and they, in turn, bring about corresponding shifts in demand and supply. These interactions are difficult to trace for any product and are doubly so in the case of coffee because of the importance of other factors in the production and consumption patterns.

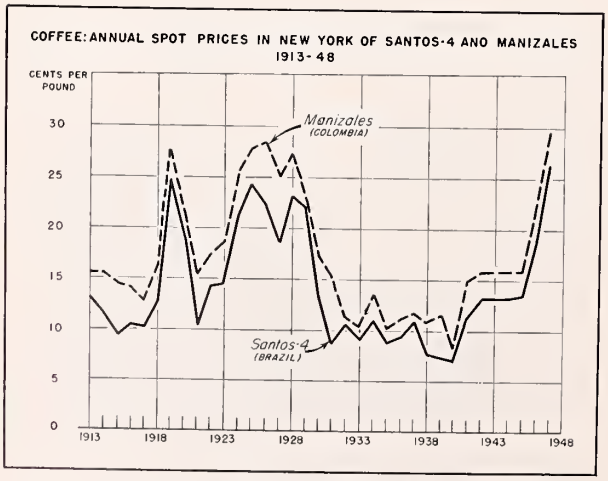

FIGURE 2.—Prices paid for mild coffee, such as Colombian, usually run somewhat higher than for Brazilian.

On the supply side, the direct response to price is in plantings, data on which are scanty, with the production response itself coming some 5 to 7 years later. Weather enters here to modify the results expected, as does the short-time cycle caused by the phenomenon of a heavy harvest usually being followed by 1 or 2 years of light production from the same trees. On the demand side, the influence of consumer purchasing power appears to exceed that of price on quantity purchased. Again, these interactions, while similar in nature, may be expected to vary from country to country, both on the producing and consuming side.

For the United States market, at least, purchasing power in the hands of consumers appears to be of importance in determining the quantity of coffee to be purchased. With a higher level of per capita income, there is a tendency to use more coffee per cup, more social functions at which coffee is served are given, coffee and light refreshments are served at civic or other organizational meetings, and between-meal coffee drinking at snack bars is more prevalent.

Trade Controls Imposed by Many Countries

For several years the European countries have imposed restrictions upon imports of coffee in the form of import tariffs, import licensing, and exchange controls. The recent tendency has been in the direction of stricter controls. Before the war (1936) the tariff on imports of coffee into the United Kingdom was 2.08 cents (U. S. currency) per pound for Empire countries and 3.13 cents for all other areas. The tariff was highest in Spain, where the duty on coffee was 88.91 cents per pound; by 1945, it had risen to $1.08 per pound. Restrictions were relatively less in the Scandinavian area, which probably accounted partly for the higher per capita level of consumption in those countries. Imports into the principal market, the United States, however, are free of duty, and the free status is bound by trade agreements with Brazil, Colombia, and several other coffee-producing countries.

Because of the importance of coffee in the economic life of the countries producing it, the unwieldy world surplus and low coffee prices of the 1930's spelled hardship to a large number of people. Brazil had succeeded intermittently in bettering its own position by valorization schemes in earlier years. The late 1920's, however, brought bumper crops that could not be sold, and Brazil began in 1931 on a program

of coffee destruction in an effort to raise prices. Other countries realized that the problem was one that concerned all of them and made arrangements for an international attack.

It was not until 1940, however, that negotiations resulted in definitive action, and an agreement was signed on November 28 by 14 producing countries and the United States. Basic quotas were established covering the amounts that could be shipped from each participating country to the United States market and to markets outside the United States. The United States agreed to limit entry of imports for consumption of coffee produced in nonparticipating countries.

The agreement provided the framework within which the principal producing countries and the major consuming nation cooperated to promote an orderly marketing of coffee. Its life was extended several times beyond the time limit of the original document, but it was allowed to expire on September 30, 1948. The Inter-American Coffee Board, which administered the agreement, has now become the Coffee Commission of the Inter-American Economic and Social Council, which is under the auspices of the Organization of American States (formerly known as the Pan American Union).

Balance Between Supply and Demand

During the recent past (beginning 1938–39) both exportable production and consumption of coffee (as measured by imports into the importing countries) declined. Imports, however, increased again in 1943, whereas production continued to decline through 1944. In fact, the two quantities were practically equal in 1944, and in 1945 imports exceeded exportable production (fig. 3) for the first time since 1931. Following World War I, the situation was similar to that of today, with imports exceeding production for a year or two, but the more recent situation appeared more or less unusual, because it followed the high production years of the 1930's when unsold coffee piled up in Brazil. By 1946, exportable production showed a response to higher prices and increased demand, and a further increase occurred in 1947. Current excessively high prices are expected to result not only in new plantings which will come into production some 5 years hence but in better care of existing trees, more widespread use of fertilizer, and intensified research to control pests and diseases. Thus, some expansion in output is expected over the next 2 or 3 years.

With coffee trees coming into bearing some 4 or 5

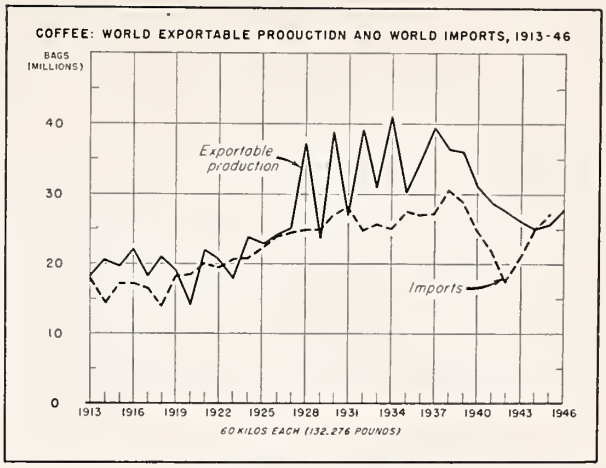

FIGURE 3.—Recent trends in exportable production and imports resemble those following World War I.

years after planting, production cycles may be expected to range from 8 to 14 years. The high prices of the middle 1870's, for example, caused large investments to be made in plantations in Brazil which resulted in large crops beginning in 1879. Large stocks brought about a declining price trend through 1886, which again resulted in overproduction and another fall in prices from 1897 to 1900. During the more recent past, the cycles have continued, being modified somewhat by artificial controls.

On the consumption side, changes in prices do not appear to have a corresponding influence on demand. The period of high production in the late 1930's, for example, resulted in the piling up of unsold coffee stocks, even though prices dropped to extremely low levels. The recent increase in prices has also failed as yet to bring about a corresponding decline in consumer demand.

For United States consumers, the past 2 or 3 years have witnessed a dramatic increase in coffee consumption, both total and on a per capita basis. This may indicate that the pattern of consumption has definitely shifted to a higher level; again, this increase may be associated with wartime factors that may soon disappear. The likelihood is that, because of in-plant feeding and other between-meal coffee drinking, per capita consumption will not fall to prewar levels, but that the rate of increase beyond the present figure will decline. For European consumers, the situation is complicated by exchange shortages, trade controls, and the necessity to limit imports to essential foods. Nevertheless, the market is already opening up, and the probability is that imports will increase gradually over the next year or two. Several years may pass, however, before prewar imports can be attained.

Agricultural Machinery in Greece

by C. S. STEPHANIDES

Greece in general is not adapted to the extensive use of large agricultural machinery, such as tractors and combines. A large portion of the country is mountainous, and about 60 percent of the cultivated land is more than 750 feet above sea level. Most of the cultivated land is steep and rocky and is cut by numerous small rivers, brooks, and gullies.

The land in the plains is divided by ownership into small sections. Mountain barriers isolate these small plains, especially in southern Greece. Only in special cases is it advisable to use large agricultural machinery on the numerous islands.

In the well-drained plains the land is divided into small units of 1 to 1.5 acres. Each farmer has a number of these small units scattered throughout the cultivated area. In eastern Macedonia, where tobacco cultivation predominates, the total area of land owned by each farmer is less than 10 acres.

Limitations to Use of Machinery

Although very fertile, the lower plains are poorly drained. The winter floods cover them for a considerable period during the year. Although the Government undertook to make these areas more suitable for cultivation by building flood-control drainage systems, the small-unit distribution of the land unfortunately creates difficulties for the proper use of machinery.

Important among the factors limiting the widespread use of plowing by tractor are the nature of the soil and climatic conditions. The soil is very heavy and hard to break up during the dry period, lasting from June to October. The rainy season likewise restricts the utilization of machinery. The planting seasons in Greece, both in the spring and in the fall, are very short. For this reason the tractors owned cooperatively by 60 to 70 farmers, since it is not profitable for them to be owned by smaller groups owing to the small individual landholdings, would be of little value in seedbed preparation under the prevailing system of field organization. On the other hand, each farmer with his pair of oxen, cows, mules, horses, or water buffaloes can easily take advantage of this short period of planting.

Whether or not a farmer shares in the cooperative ownership of a tractor, he is obliged to keep a pair of work animals for his other numerous needs, such as transporting the crops from the fields to his home, hauling his goods to the market, taking his grain to the flour mill, hauling wood, and taking the sick to the doctor. These are just a few of the needs for which a team is essential. As it is indispensable for the American farmer to have a car, in addition to a tractor, it is just as indispensable for the Greek farmer to have his team. A tractor, invaluable in special instances, cannot provide all the essential services required by the farmer.

Introduction of Heavy Machinery

The Greek farmer is naturally gifted in handling mechanical equipment and has successfully used complicated farm machinery even under difficult conditions. In spite of the fact that he has often lacked the theoretical knowledge of machinery, he has made good use of various implements as to operation, upkeep, and repair. When the land was divided into small holding by the Land Act, however, the use of such agricultural machinery dwindled. The tractor has almost disappeared, animal power having largely replaced it for cultivating the land.

Heavy agricultural machinery was first introduced in Thessaly. Most of the land in large holdings was plowed with tractors, and threshing was done with 54-inch threshers imported from England. Before

Plowing with a team of oxen.

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World War II Greece had 1,750 tractors with 73,500 horse power of the following type and ownership:

Ownership	*Number*	*H. p.*
(a) Crawler type:		
Government	150	8, 250
Individuals	400	22, 000
Agricultural Cooperatives	50	2, 750
Total	600	33, 000
(b) Wheel type:		
Government	180	6, 300
Individuals	915	32, 000
Agricultural Cooperatives	55	2, 200
Total	1, 150	40, 500
Grand total	1, 750	73, 500

These machines were used most widely on the large plains of northern Greece (Macedonia, Thrace, and Thessaly). Here there were even more tractors, combines, and threshers than were actually needed. This machinery was imported from different European countries, mainly Germany, and from the United States. Some companies would provide parts, but some would not, and the acquiring of new parts at exorbitant prices caused the greatest difficulty of the owners; work was often delayed for weeks and sometimes for months.

The poor farmer who scarcely makes a decent living out of his meager farming cannot afford to speculate on the efficiency of the machine to take care of his field work. It is life and death for him whether his fields are planted or not, and such delays, due to lack of parts or lack of fuel as happens in countries that do not produce fuel, are too risky.

Use of Threshers

There were 900 threshing machines in Greece before World War II. They were owned cooperatively by each village and also by individuals. After World War I, the small landowners organized strong cooperatives and felt the need of the heavy-type threshing machines (54-inch) powered with Diesel tractors of 50 to 70 horse power. In 1936, Thessaly and Macedonia had even more of this heavy machinery than was actually needed. Because of competition between the many threshing outfits, the charge to the farmers for threshing was reduced from 12 percent to 6 percent of the yield. The 6-percent charge was not enough to maintain the unit because of the long distances between the farms requiring its services. The average service area of each threshing machine was 1,200 hectares (3,000 acres). Lately this has been reduced to 800 hectares (2,000 acres). Each threshing machine threshed yearly 768,000 kilograms of grain (about 28,000 bushels) and worked 55 days during the year.

A horse-drawn wagon serves for transportation in Greece, whereas a truck or motor would more likely be used in many other countries.

Binders for Harvesting Grain

Most of the harvesting of cereals was done with small binders (chiefly American-made), with a width of 5 to 6 feet. The largest number of these binders was in Thessaly. Each machine harvested 74 hectares (185 acres). In northern Greece 200 hectares (500 acres) of cereals were grown for each binder in the area, and in southern Greece 5,400 hectares per machine (13,500 acres). In southern Greece the use of these machines is limited owing to the size and topography of the fields.

Grain Drills Popular

Another type of agricultural machinery used extensively throughout Greece was the grain drill. In 1936 there were 10,000 of these. They were 5- to 6-disk drills and were mostly imported by the Agricultural Bank. They gave more valuable service than any other piece of agricultural machinery introduced in Greece.

Formerly the grain was broadcast by hand and then plowed under. Because the seed was covered too deeply, about one-third of the seed was lost. If all wheat planted in Greece (800,000 hectares or 2,000,000 acres) were drilled, approximately 37,000 tons of wheat seed would be saved each year. In addition, drilling tends to level the ground, leaving it in a much better shape for mechanical harvesting than does the broadcast-and-plow method. It also helps the farmer in combatting weeds, which have become a menace as a result of continuous wheat cropping in the same field.

Threshing grain with oxen on a small farm.

Cleaners and Shellers Also Helpful

Additional machinery in 1936 included 4,000 hand-powered and 52 machine-powered grain cleaners, which were used to separate broken kernels, other seeds, and foreign matter from wheat after threshing by machine; 4,500 hand-operated cleaners, which separated chaff and dirt from grain following the old-type floor threshing; and 2,800 corn shellers. All these were needed and more could have been used.

Plows Varied in Type and Use

The plows used in Greece are in general steel plows with iron frames. According to the annual agricultural statistics of 1936, 56 percent were of this type. The remainder were wooden plows with steel points. About 67 percent of the plows in northern Greece and only 44 percent of those in southern Greece were iron. The average weight of these iron plows varies from 25 to 40 kilograms (55 to 88 pounds), depending upon the areas where they are used and upon field conditions. The heaviest plows are used mostly in Thessaly and Macedonia. Usually the preparation of the soil—plowing, harrowing, and covering the seed—is done with the plow. The depth of plowing does not exceed 5 inches. In many cases either wooden or iron harrows complete these operations. The iron harrow is replacing the wooden harrow in northern Greece and is considered an essential implement in soil preparation.

Need for Heavy Machinery

Since 1922 extensive importation of heavy agricultural machinery by the Ministry of Agriculture has been necessary owing to refugee-resettlement problems. The large tracts of land which were once used by the Turks for pasture purposes had to be broken up for redistribution to the new settlers. No animal power could successfully break up the land that had been pounded by grazing animals and covered with brush for centuries. Only with machinery could the soil be broken up so that draft animals could easily work it. Farm roads and ditches for drainage could likewise be made only with heavy machinery.

Another need for heavy agricultural machinery was created by the reclamation projects carried out by the Ministry of Agriculture in Macedonia. Extensive flood-control projects, drainage of swamps and lakes, and the preparation of reclaimed land for cultivation by the small farmers were made possible only through the use of heavy machinery.

Postwar Situation And Present Prospects

As a result of the reduction in draft power during World War II, the utilization of more machine power was urgent or necessary in the postwar period, and perhaps more will be needed until the prewar numbers of livestock for draft power are replaced. At present there are 576 more tractors in Greece, and an increase of 15,400 h. p., compared with the prewar period. Comparable figures for tractors by type, number, ownership, etc., are as follows:

Ownership	*Number*	*H. p.*
(a) Crawler type:		
Government	175	10, 000
Individuals	220	12, 000
Agricultural Cooperatives	20	1, 200
Total	415	23, 200
(b) Wheel type:		
Government	380	14, 800
Individuals	1, 001	30, 900
Agricultural Cooperatives	530	20, 000
Total	2, 911	65, 700
Grand total	2, 326	88, 900

Considering landownership, the topography of the country, and the division of holdings into smaller plots scattered about the village, it is questionable whether Greece can now economically employ many more tractors or other heavy agricultural machinery than before the war. Also, the lack of fuel resources presents a serious problem. There is also the question of what effect such mechanization would have in the way of further unemployment of farm workers. Even with the present methods employed in farming, a large portion of the farm population is without work most of the time.

Following a review of the literature available on agricultural machinery in Greece and correlating it with personal experience in the type of farming existing in Greece, the writer reached the following conclusions:

(1) The tractor cannot do all farm work under all types of soil and climatic conditions. This necessitates the availability at all times of animal power.

(2) The cost of tillage has in the past been greater with tractors than with draft animals. The figures of the Ministry of Agriculture and other agencies show that the cost of plowing with tractor power in the prewar period was $1.80 per acre and with animal power, $1.44 per acre. The reasons for the higher cost of tractor power are:

(a) Expense of moving machinery from one field to another.
(b) Difficulty in finding parts for the machinery.
(c) Lack of well-trained personnel for the proper operation of the machinery.
(d) Poor adaption of machinery to the hilly areas where much of the cultivated land lies.
(e) Original and operational cost of the machinery. Everything has to be imported, including fuel.

(3) The machinery cannot utilize the byproducts of the farm, such as straw, hay, and other grain byproducts.

(4) By replacing animals, the means for converting byproducts into power, meat, and manure are lost.

(5) Machine power cannot always be relied upon to cultivate and plant the seed in the proper season, which at times is an important factor in crop production. The lack of replacement parts or some small trouble with the engine might deprive the farmer of his meager income.

A cooperatively owned threshing machine.

A vender of fruits and vegetables uses a burro to transport his wares.

(6) Traditional *land-plant-animal-power-farmer balance* should not be upset without serious consideration as to the consequences.

(7) The following operations, however, do call for the use of heavy machinery:

(a) Breaking up forest or pasture land for cultivation.
(b) Deep plowing in areas where the subsoil is more fertile than the topsoil.
(c) Fitting the land for vineyard planting or fruit-tree planting.
(d) Draining small swamps where deep and wide ditches are necessary to get rid of the excess water, also, for the maintenance of road ditches and irrigation ditches by the communities.
(e) Improving pastures. Reseeding of new pastures sometimes necessitates breaking up the soil.
(f) Moving threshing machines and supplying power for the threshing machine.
(g) Fitting and cultivating where arrangements are made involving cooperative working of the land to overcome difficulties due to field size and distribution, as well as cooperative ownership of machinery.

(8) The ownership of such heavy machinery is possible through strong cooperatives. Arrangements for acquiring and using such machinery should be under the guidance and training of the Department of Agricultural Machinery, in the Ministry of Agriculture.

INTERNATIONAL *Agricultural News*

FAO to Hold Annual Conference In Washington

Over 500 delegates from 57 Member nations are expected to attend the Fourth Session of the Conference of the United Nations Food and Agriculture Organization, which is opening in Washington, D. C., on November 15. Previous conference sessions were held in Quebec (1945), Copenhagen (1946), and Geneva (1947). The United States has had an important role in the formation and early history of this organization. The meeting which led to its formation was held in Hot Springs, Virginia, in 1943, at the invitation of President Roosevelt. Two years later the organization was formally constituted at the Quebec Conference.

The delegates to the Washington Conference are expected to include national leaders in the fields of agriculture, forestry, fisheries, nutrition, and rural welfare. Among these the United States will be welcoming back a number of friends who were present at Hot Springs; others will be visiting the United States for the first time. Though the Conference, which is expected to last 2 weeks, will be a busy one, the United States Government and interested organizations have made preparations to show the delegates as much of American agriculture as available time will allow.

A Committee on Entertainment and Hospitality has been working on this matter for some 3 months. In addition to Federal and State Government officials, it has included leaders of farm, fishery, and forest organizations. Final decision on events cannot be made until the delegates register and express their interests, but tentative plans include an official reception, trips to various points of interest, and informal social gatherings.

A number of important subjects will be discussed by the Conference. In preparation for this, each member nation was asked to report on its production program and food policy for the year ahead. These reports have been analyzed by the FAO staff, and the Director General will make a report on the outlook in view of these policies as seen against the background of world food needs. With exporting countries facing the possibility of near surpluses as a result of this year's bumper crops, and with importing countries frequently still short of food and still pushing for higher production, this discussion of agricultural policy should be of great significance.

In addition, the Conference will review the FAO accomplishments for the past year and consider its proposed program of work and budget for 1949, as well as related administrative matters of the organization.

One item of particular interest to the United States will be the discussion of a permanent site for FAO. Headquarters of the organization have been temporarily located in Washington. An earlier Conference indicated a preference for a location at, or near, the site of the United Nations, if suitable arrangements could be made; and a committee was appointed to investigate the matter further. That committee has now limited its investigation to five cities: Washington, New York, Copenhagen, Rome, and Geneva.

All meetings of the Conference will be held in the Shoreham Hotel in Washington. Plenary sessions are usually open to the public. Much of the work will be done in three commissions which will meet simultaneously. Most of such meetings are also generally open to the public.

On November 8, the 18-nation Council of FAO, which is the governing body between conferences, will meet in Washington to make final conference plans.

The Inter-American Conference at Denver

The Inter-American Conference on the Conservation of Renewable Natural Resources was held in Denver from September 7 through September 21. All the countries of the Western Hemisphere were represented there by technicians and Government officials. There is every reason to believe that this first international conference which has attempted to outline and secure proper recognition of conservation problems and policies was indeed a great success.

The many interesting papers presented indicated the need of an international approach to the problems involved, the essential needs of laymen education, research facilities, and larger numbers of technically trained personnel to resolve successfully the problems of conservation.

A wonderful tribute was paid to Dr. H. H. Bennett, Chief of the Soil Conservation Service, United States Department of Agriculture, for his outstanding leadership in the United States, and throughout the world, in efforts to arouse people, technicians, and Governments to the essential need of conservation practices. Recognition and gratitude on the part of Western

Hemisphere countries was expressed to the United States Government and its various agencies for the assistance which has been provided in the counsel and training of Latin American technicians in the field of conservation of renewable natural resources.

U. S. Botanist Cordially Received in Latin America

Traveling in South and Central America under the Department of State's program of International Exchange of Persons, Dr. W. W. Robbins, Professor of Botany, College of Agriculture, University of California, has been received with much enthusiasm in all the countries he has visited. He has conferred with ministries of agriculture, colleges and universities of agriculture, and farm and business organizations on weed-control problems as related to the general agricultural situation.

Dr. Robbins went to Rio de Janeiro in May of this year on the first lap of a tour to 14 countries. Meetings and travel arrangements have been scheduled by American embassies in the various American Republics he has visited. He expects to return to the United States by way of Mexico the latter part of November.

OFAR's Work Under RMA Program

Under the Department's Research and Marketing Act program, the Office of Foreign Agricultural Relations has been conducting studies of existing and potential foreign markets for United States agricultural products. Commodity specialists of this Office and other bureaus of the Department have made personal surveys in various producing and importing countries of the world, in order to evaluate the situation with regard to the development of markets for a number of commodities commonly exported by this country.

From September through June 1948, surveys were completed in western European countries concerning the outlook for exports of fresh fruits, cotton, tobacco, and potatoes. The cotton situation was studied in Japan, China, India, and Pakistan. The rice markets of Europe and the situation in producing countries of the Near and Far East were observed. Other undertakings, under way but not completed on June 30, include a survey of the tree-nut situation in the western Mediterranean areas, a study of cotton utilization and production in South America, and a program of technical assistance to European tobacco manufacturers.

Reports containing observations and conclusions by the various commodity specialists are mentioned in this magazine from time to time under "Reading About Foreign Agriculture." An over-all summary of countries visited and commodities studied by the specialists during September–June 1947–48 appears in the following tabulation:

Country or Territory	*Commodity*	*Specialist*
Austria	Tobacco, cotton, potatoes	Gibbs, Cheatham, Norris, Mercker.
Belgium	Tobacco, cotton, fruit, potatoes	Gibbs, Cheatham, Motz, Mercker, Norris.
Brazil	Cotton	Norris.
Burma	Rice	Efferson.
Canada	Fruit	Motz.
China	Cotton, rice	Trotter, Efferson.
Czechoslovakia	Cotton	Norris.
Denmark	Tobacco, fruit	Gibbs, Cheatham, Motz.
France	Tobacco, cotton, fruit, tree nuts, potatoes	Gibbs, Cheatham, Norris, Motz, Schreiber, Mercker.
French Indochina	Rice	Efferson.
Germany	Tobacco, cotton, fruit, potatoes	Gibbs, Cheatham, Norris, Motz, Mercker.
Hungary	Cotton	Norris.
Hong Kong	Rice	Efferson.
India	Cotton	Trotter.
Ireland	Tobacco	Gibbs, Cheatham.
Italy	Tobacco, cotton, tree nuts, potatoes	Gibbs, Norris, Schreiber, Mercker, Norris.
Japan	Cotton, rice	Trotter, Efferson.
Korea	Rice	Efferson.
Malaya Federation & Straits Settlements	Rice	Efferson.
Netherlands	Tobacco, cotton, fruit, potatoes	Gibbs, Cheatham, Motz, Mercker.
Netherlands Indies	Rice	Efferson.
Norway	Tobacco	Gibbs, Cheatham.
Pakistan	Cotton	Trotter.
Portugal	Tobacco, tree nuts, potatoes	Gibbs, Schreiber, Mercker.
The Republic of the Philippines	Rice	Efferson.
Siam	Rice	Efferson.
Spain	Tobacco, tree nuts, potatoes	Gibbs, Schreiber, Mercker.
Sweden	Tobacco, fruit	Gibbs, Cheatham, Motz.
Trieste	Potatoes	Mercker.
United Kingdom	Tobacco, cotton, fruit, potatoes	Gibbs, Cheatham, Norris, Motz, Mercker.

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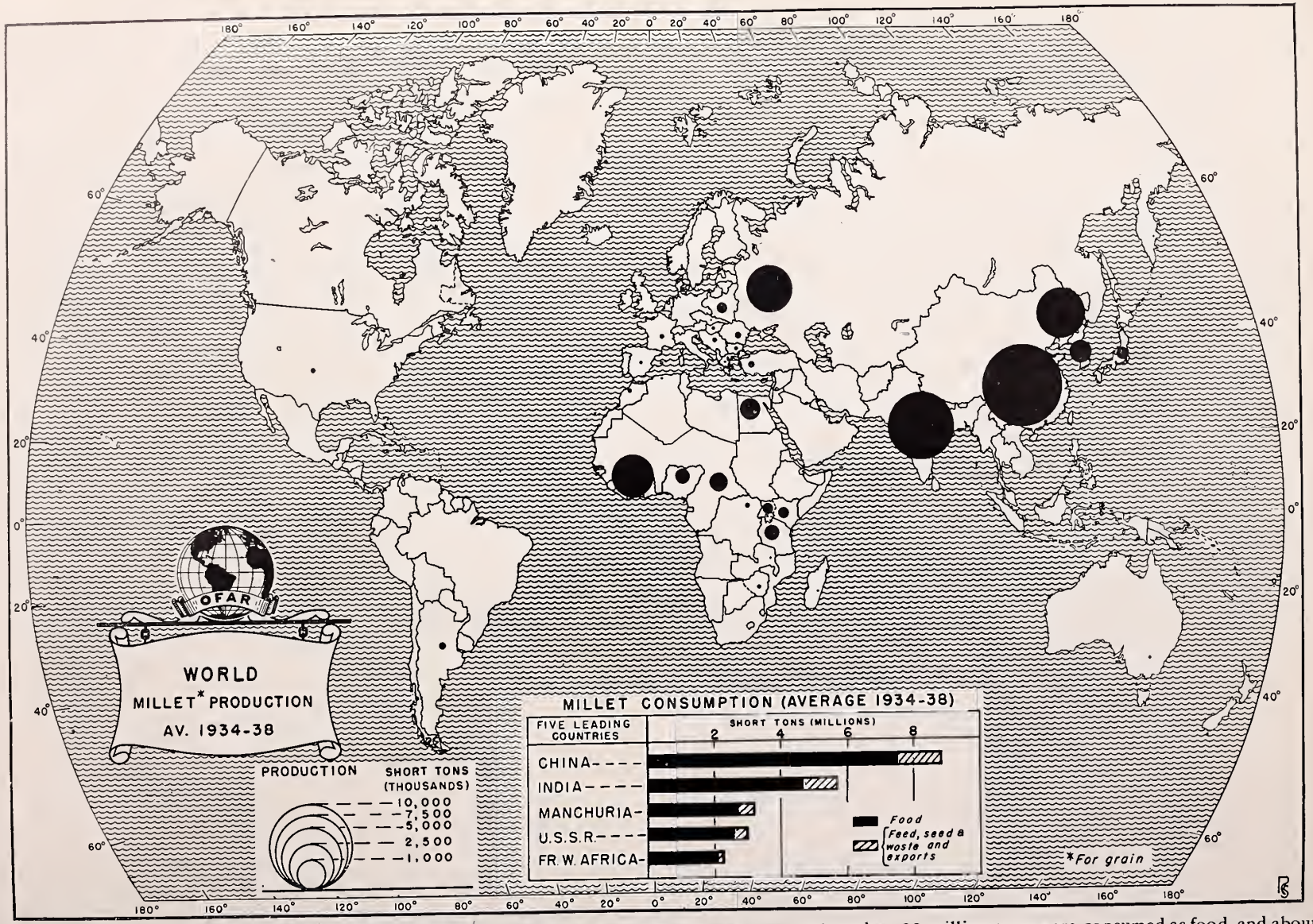

The annual world production of millet during 1934–38 averaged about 26 million short tons. More than 22 million tons were consumed as food, and about 1.5 million were fed to poultry and livestock. China, India, Manchuria, the Soviet Union, and French West Africa were the principal producing and consuming countries.